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**Method and Apparatus for Maintaining
State Information**

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1 **TECHNICAL FIELD**

2 The systems and methods described herein relate to maintaining state
3 information for a client device.
4

5 **BACKGROUND**

6 A client device in a television-based system can receive video and audio
7 content from a program distributor in the form of broadcast programs, such as
8 news programs, sitcoms, movies, sporting events, commercials, and any other type
9 of television-based information. A client device may also receive other types of
10 data, such as data associated with a remote application. A client device includes,
11 for example, a set-top box, a digital satellite receiver, a cable box, a digital video
12 recorder (DVR), and a television with a built-in receiver.

13 Existing client devices store user settings, preferences, and account
14 information. For example, a persistent memory device may be included in client
15 devices to store settings, preferences, and other information. Adding a persistent
16 memory device to a client device increases the cost and complexity of the client
17 device.

18 Television broadcasting systems (such as cable TV broadcasters or satellite
19 broadcasters) originate and communicate signals to customers from a headend (or
20 “head-end”). The headend contains equipment to broadcast signals and provide
21 other services to multiple customers. A headend interacts with each client device
22 to provide content that is appropriate for the client device based on the settings,
23 preferences and account information associated with the client device. This
24 arrangement can cause a loss of data if the client device malfunctions. Loss of
25 data usually requires re-configuration of the client device by the user.

1 Additionally, if a particular household has multiple client devices (e.g., coupled to
2 multiple televisions), each client device is typically configured separately from the
3 other client devices. This separate configuration of each client device can be
4 tedious, especially when each client device is configured in a similar manner.

5 6 **SUMMARY**

7 The systems and methods described herein maintain configuration
8 information for a client device in a remote location. In a particular embodiment, a
9 client device having an associated identifier is initialized. The identifier
10 associated with the client device is communicated to a configuration server that
11 contains configuration information associated with the client device. The
12 configuration information is received from the configuration server and is applied
13 to the client device. Data, such as video data, is then received from the
14 configuration server.

15 16 **BRIEF DESCRIPTION OF THE DRAWINGS**

17 Similar reference numbers are used throughout the figures to reference like
18 components and/or features.

19 Fig. 1 illustrates various components of an example architecture capable of
20 providing content to one or more client devices.

21 Fig. 2 is a flow diagram illustrating an embodiment of a procedure for
22 configuring a client device.

23 Fig. 3 is a flow diagram illustrating an embodiment of a procedure for
24 implementing task requests received by a client device.

1 Fig. 4 is a flow diagram illustrating an embodiment of a procedure for
2 updating configuration information associated with a client device.

3 Fig. 5 illustrates example configuration information associated with a
4 particular client device.

5 Fig. 6 illustrates an example client device and related devices that are
6 associated with the client device.

7
8 **DETAILED DESCRIPTION**

9 The systems and methods described herein store configuration information
10 associated with a client device in a storage device, such as a server, associated
11 with a headend system that provides content to the client device. By storing this
12 configuration information remotely from the client device, the configuration
13 information is not lost in the case of a client device malfunction. Additionally, the
14 same configuration information can be downloaded into multiple client devices,
15 thereby eliminating the need for users of multiple client devices to manually enter
16 the same configuration information in each of the multiple client devices.

17 The systems and methods described herein also allow users or other
18 systems to access the configuration information from the headend systems without
19 requiring interaction with the client device with which the configuration
20 information is associated. Additionally, by storing configuration information
21 remotely, the remote system may customize data sent to the client device such that
22 the customized data is limited to information that the client device can use. This
23 customization of data reduces the amount of data that is sent to the client device as
24 compared to systems that send large amounts of data to a client device, which
25 filters out unnecessary data.

1 When utilizing the systems and methods discussed herein, the client device
2 may have limited resources, such as no persistent memory, because the
3 configuration information that needs to be persisted is stored remotely from the
4 client device. By reducing resources in the client device, the cost and complexity
5 of the client device is also reduced.

6 The systems and methods discussed herein are described with reference to
7 an environment in which content is distributed to client devices via a data
8 communication network, such as the Internet. These examples represent one
9 possible environment in which the systems and methods can be implemented. In
10 other embodiments, any type of system or architecture can be used to provide
11 content to one or more client devices.

12 Client devices of the type discussed herein range from clients with
13 substantial memory and processing resources, such as television-enabled personal
14 computers and television recorders equipped with hard-disks, to clients with little
15 or no memory and/or limited processing resources. Although particular examples
16 of client devices are discussed herein, any client device can be used with the
17 systems and methods described. Example client devices include personal
18 computers, DVD players, digital video recorders (DVRs), set top boxes, cable
19 boxes, satellite receivers, televisions, game consoles, and the like. As used herein,
20 the term “user” may also be referred to as “viewer”. Also, as used herein, the
21 terms “state information”, “configuration information”, and “configuration
22 settings” are used interchangeably.

23 Fig. 1 illustrates various components of an example architecture 100
24 capable of providing content to one or more client devices 102. In this example
25 architecture 100, content (such as television programs, video on demand,

1 advertisements, and the like) is distributed via a data communication network 104,
2 such as the Internet. Architecture 100 provides two-way communication of data
3 between client devices and one or more servers via network 104. In alternate
4 embodiments, content is distributed to client devices 102 via a cable network,
5 radio frequency signals, over-the-air broadcast, satellite communication systems,
6 and the like.

7 In a particular embodiment, client devices 102 communicate with one or
8 more servers via network 104 using simple object access protocol (SOAP)
9 messages transported using hypertext transfer protocol (http), a protocol
10 commonly used by the World Wide Web. In other embodiments, any type of
11 protocol and/or messaging format can be used to exchange data between client
12 devices 102 and one or more servers.

13 Each client device 102 has a unique identifier stored within the client
14 device. For example, the unique identifier may be stored in a non-volatile
15 memory device or other component of the client device. Since each client device
16 102 has a unique identifier, each client device can be distinguished from the other
17 client devices. Although not shown in Fig. 1, each client device 102 may be
18 coupled to a display device (such as a television, computer monitor, or projector),
19 a recording device (such as a VCR or DVR), or other device. Alternatively, one or
20 more client devices 102 may themselves be televisions, recording devices, or other
21 devices.

22 In the example of Fig. 1, network 104 may be any type of data
23 communication network and may include two or more different networks, such as
24 a local area network (LAN) and the Internet. A web server 106 is also coupled to
25 network 104. In one embodiment, web server 106 is an Internet Information

1 Server (IIS), available from Microsoft Corporation of Redmond, Washington. A
2 configuration server 108 is coupled to web server 106 and functions to maintain
3 configuration information related to client devices 102. As discussed below,
4 configuration server 108 also receives requests for configuration information from
5 client devices 102 and provides the requested configuration information to the
6 client devices.

7 An account server 110 and a database 112 are coupled to configuration
8 server 108. Account server 108 maintains information regarding customer
9 accounts, customer subscriptions, customer billing histories, and the like. For
10 example, account server 108 can maintain information regarding one or more
11 client devices associated with a customer's account and payment status of the
12 customer's account invoices. Database 112 stores various information used by
13 configuration server 108, such as configuration information related to client
14 devices 102. Database 112 may also store information used by account server 110,
15 such as billing information and customer account information.

16 A recommendation server 114 is coupled to configuration server 108 and
17 network 104. Recommendation server 114 generates, for example, television
18 program recommendations for one or more client devices 102. A marketing server
19 116 is also coupled to configuration server 108 and network 104. Marketing
20 server 116 generates, for example, advertisements and other marketing content that
21 is provided to one or more client devices 102. The advertisements and other
22 marketing content may be targeted to particular client devices 102 based on known
23 viewing habits or preferences of the users of those particular client devices.

24 Various other servers (not shown) may be coupled to configuration server 108 and
25 network 104 to communicate with configuration server 108 and client devices 102.

1 These other servers can request configuration information regarding client devices
2 102 from configuration server 108 and use that information to generate content,
3 advertisements, and the like that are communicated to client devices 102.

4 Examples of other servers that may be coupled to configuration server 108
5 include a customer service server that accesses configuration information to allow
6 a customer service agent to help a customer configure their client device and
7 servers that run remote applications. Remote applications can, for example,
8 generate user interface data that is provided to the client device, thereby allowing
9 the client device to display a high-quality user interface without requiring the
10 client device to have the resources necessary to generate the user interface.

11 Traditional television broadcasting systems (such as cable TV broadcasters
12 or satellite broadcasters) originate and communicate signals to customers from a
13 headend, as discussed above. In the architecture of Fig. 1, the headend may be
14 considered as the equipment used to broadcast content and provide other services
15 to multiple customers (e.g., via client devices 102). The headend interacts with
16 each client device 102 to provide content that is appropriate for the client device
17 based on the settings, preferences, and account information associated with the
18 client device. Referring to Fig. 1, any one or more of the following devices may
19 be considered as the “headend”: web server 106, configuration server 108,
20 account server 110, database 112, recommendation server 114, and marketing
21 server 116. In other embodiments, one or more additional devices may be
22 considered part of the headend.

23 In the example of Fig. 1, configuration information associated with each
24 client device 102 can be accessed via configuration server 108. Thus, rather than
25 storing configuration information in each client device 102, the client devices

1 retrieve necessary configuration information from configuration server 108, which
2 retrieves the configuration information from database 112. This arrangement
3 simplifies client device 102 by eliminating the need for the client device to have a
4 storage device to store configuration information. Additionally, a client device can
5 be relocated (e.g., to another household) or replaced without having to reconfigure
6 the client device.

7 By providing persistent storage of client device configuration information
8 on a remote device (e.g., configuration server/database), the configuration
9 information is not lost if the client device malfunctions. Additionally, the storage
10 reliability of the configuration information can be enhanced by providing
11 redundant storage devices such as mirrored storage devices or tape backup
12 systems. Multiple client devices can be configured to be identical to one another
13 by associating the same configuration information with each client device. The
14 architecture of Fig. 1 also allows servers or other devices to retrieve configuration
15 information from the configuration server without requiring any interaction with
16 the client device.

17 Although not shown in Fig. 1, architecture 100 may also include one or
18 more additional servers coupled to network 104 or another component of Fig. 1.
19 For example, a video content server may be coupled to network 104 and/or
20 coupled to web server 106 to distribute video content (as well as audio content) to
21 one or more client devices 102.

22 Fig. 2 is a flow diagram illustrating an embodiment of a procedure 200 for
23 configuring a client device. Procedure 200 begins at block 202 where a client
24 device is initialized (e.g., powered on or reset). The client device then
25 communicates an identifier associated with the client to a configuration server

1 (block 204). This identifier is, for example, a unique identifier that distinguishes
2 the client device from other client devices having different identifiers. The client
3 device also communicates a request for configuration information to the
4 configuration server (block 206). For example, the requested configuration
5 information may include the last channel received by the client device, favorite
6 channel listings, parental control settings, language preferences, channel sorting
7 order, and the like. The request for configuration information may request all
8 available configuration information or may request specific configuration
9 information (such as a last channel viewed). If specific configuration information
10 is requested at initialization, additional configuration information can be requested
11 at a later time when the configuration information is needed (e.g., when a user
12 requests to view a favorite channel).

13 As procedure 200 continues, the configuration server identifies the
14 requested configuration information associated with the client device based on the
15 identifier provided by the client device (block 208). For example, the
16 configuration server may retrieve the configuration information from an attached
17 database or other storage mechanism. The configuration server then formats the
18 requested configuration information into an appropriate format (block 210), such
19 as an html format. Alternate embodiments may use other formats, such as
20 serialized binary objects, plain text, and the like. Procedure 200 continues as the
21 configuration server communicates the formatted configuration information to the
22 client device (block 212). The client device receives the configuration information
23 and applies the configuration information (block 214). For example, if the
24 configuration information includes last channel information, the client device
25 tunes to the last channel.

1 Fig. 3 is a flow diagram illustrating an embodiment of a procedure 300 for
2 implementing task requests received by a client device. Initially, a client device
3 receives a request from a user to perform a task (block 302). The task may include
4 changing channels, displaying a program guide, displaying available video on
5 demand (VOD) programs, or displaying a configuration menu. The client device
6 then determines whether configuration information is needed to perform the task
7 (block 304). For example, changing channels may not require additional
8 configuration information, but displaying a program guide or displaying a list of
9 favorite channels may require additional configuration information from the
10 configuration server. If no additional configuration information is needed, the
11 procedure branches to block 314 where the client device performs the requested
12 task.

13 In another embodiment, block 304 may also determine whether the
14 configuration information is already stored in the client device (e.g., from a
15 previous request for the configuration information). If the configuration
16 information is already stored in the client device, the client device uses the stored
17 configuration information. Otherwise, the client device continues to block 306 as
18 discussed below.

19 If additional configuration information is needed, the procedure continues
20 from block 304 to block 306 where the client device communicates a request for
21 the necessary configuration information to the configuration server. In one
22 implementation, each request specifies the identifier associated with the client
23 device communicating the request. Alternatively, the identifier associated with the
24 client device communicating the request could be sent over a session that has been
25 established with a specific client, which implies the client's identifier.

1 The configuration server then retrieves the requested configuration
2 information associated with the client device (block 308). Next, the configuration
3 server formats the requested configuration information into an appropriate format
4 and communicates the formatted configuration information to the client device
5 (block 310). The client device receives the requested configuration information
6 and applies the configuration information (block 312). Finally, the client device
7 performs the task requested by the user of the client device (block 314).

8 After the task is completed, the requested configuration information may be
9 discarded by the client device. If the client device needs the same configuration
10 information in the future, the client device can request the same configuration
11 information again. When operating in this manner, the client device always
12 receives a current copy of the configuration information.

13 Fig. 4 is a flow diagram illustrating an embodiment of a procedure 400 for
14 updating configuration information associated with a client device. Initially, a user
15 of a client device changes a configuration setting associated with the client device
16 (block 402). For example, the user of the client device may add a new favorite
17 channel or change a parental control setting. The client device applies the change
18 made by the user of the client device (block 404). The client device then
19 communicates the change to the configuration server (block 406). The
20 configuration server updates the stored configuration information associated with
21 the client device based on the change made by the user of the client device (block
22 408). By updating the configuration information stored by the configuration
23 server, the user's change will be applied to the client device during subsequent
24 initializations of the client device.
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1 In an alternate embodiment, the configuration information associated with
2 one or more client devices is changed by a user interacting with the configuration
3 server. For example, a user may access the configuration server via a Web
4 browser application. The user then accesses a current version of the configuration
5 information, makes any desired changes, and saves the modified configuration
6 information on the configuration server. In one embodiment, these changes are
7 communicated to the client device and applied by the client device as soon as they
8 are entered by the user. In other embodiments, the updated configuration
9 information is communicated to the client device after subsequent initializations of
10 the client device.

11 Fig. 5 illustrates example configuration information 502 associated with a
12 particular client device. The configuration information shown in Fig. 5 may be
13 associated with, for example, a particular database record. A device ID 504 is a
14 unique identifier associated with the particular client device. Device ID 504 may
15 contain any number of letters, numbers, or other characters or symbols. A last
16 channel 506 indicates that the last channel tuned or otherwise displayed by the
17 client device is channel 118. A favorite channel list 508 identifies channels 102,
18 118, 177, 179, 212, 247, and 265 as favorite channels associated with the client
19 device. A language preference 510 indicates that English is the preferred language
20 associated with the client device. Parental control settings 512 identify various
21 restrictions based on channels, program ratings, and program times. For example,
22 channels 119, 127, 128, 135, 171, 172, and 173 are not viewable on the client
23 device. Additionally, any program rated PG-13, R, NC-17, X, TV-14, or TV-M is
24 not viewable on the client device. The client device is also restricted with respect
25

1 to time such that no program can be viewed between 9pm and 8am on weekdays
2 and no program can be viewed between 10pm and 8am on weekends.

3 Fig. 5 illustrates one example of configuration information associated with
4 a client device. In other embodiments, additional types of configuration
5 information may be specified and/or certain configuration information shown in
6 Fig. 5 may be omitted. The configuration information displayed in Fig. 5 may be
7 stored in any format using any data structure, such as a table, database, or other
8 structure.

9 In one embodiment, a household, business, or other organization may use
10 multiple client devices of the type discussed herein. In this embodiment, there
11 may be a single set of configuration information associated with the household
12 that is applied to all client devices. Thus, a single set of configuration information
13 is established and applied to all client devices. This set of configuration
14 information may have an associated unique identifier.

15 Utilizing household configuration information eliminates the need to
16 individually configure each of the client devices. Additionally, the household
17 configuration information may be used as a default configuration for each client
18 device, which can be overridden by configuration information associated with a
19 particular client device. For example, the household configuration information
20 may prohibit viewing of programs with a rating of PG-13 or higher. However,
21 configuration information associated with a particular client device may override
22 that prohibition by allowing the particular client device to display programs with
23 any rating. In a particular embodiment, information regarding client devices
24 associated with a common household is maintained by the account server.
25

Fig. 6 illustrates an example client device 600 and related devices that are associated with the client device. Client device 600 includes a processor 602, an optional memory device 604, and a tuner 606. Processor 602 includes, for example, a microprocessor or controller, which processes various instructions to control the operation of client device 600 and to communicate with other devices. Memory device 604 is optional and may be implemented, for example, as a disk drive, a random access memory (RAM), a read-only memory (ROM), or a flash memory. Memory device 604 may store a unique identifier, configuration information, or other data. Tuner 606 may be an in-band tuner that tunes various frequencies or channels to receive television signals or an out-of-band tuner that tunes to the broadcast channel over which program data is broadcast to client device 600. Tuner 606 may include hardware-based tuners and/or digital tuners (e.g., software tuners) capable of “tuning” or identifying IP-based digital streams of data. IP-based digital streams serve a similar function as tuners, but are used in an IP environment for the delivery of content (e.g., the unicast delivery of content).

Client device 600 also includes a communication interface 608, a modem 610, and an audio/video output 612. Communication interface 608 can be implemented as a serial and/or parallel interface, as a wireless interface, and/or any other type of network interface. A wireless interface allows client device 600 to receive control input commands 622 and other information from a user-operated input device, such as from a remote control device 624 or from another infrared (IR), 802.11, Bluetooth, or similar RF input device. Input devices can include a wireless keyboard or another handheld input device 626 such as a personal digital assistant (PDA), handheld computer, wireless phone, or the like. A network

1 interface and a serial and/or parallel interface enables client device 600 to interact
2 and communicate with other electronic and computing devices via various
3 communication links. Modem 610 facilitates client device 600 communicating
4 with other electronic and computing devices via a data communication network, a
5 conventional telephone line, a DSL connection, a cable connection, and/or other
6 type of connection.

7 Audio/video output 612 provides audio, video, and/or display signals to a
8 television 620 or to other devices that process and/or display, or otherwise render,
9 the audio and video data. Video signals and audio signals can be communicated
10 from client device 600 to television 620 via an RF (radio frequency) link, S-video
11 link, composite video link, component video link, or other similar communication
12 link.

13 Although shown separately, some of the components of client device 600
14 may be implemented in an application specific integrated circuit (ASIC).
15 Additionally, a system bus (not shown) may connect the various components
16 within client device 600. A system bus can be implemented as one or more of any
17 of several types of bus structures, including a memory bus or memory controller, a
18 peripheral bus, an accelerated graphics port, or a local bus using any of a variety
19 of bus architectures. By way of example, such architectures can include an
20 Industry Standard Architecture (ISA) bus, a Micro Channel Architecture (MCA)
21 bus, an Enhanced ISA (EISA) bus, a Video Electronics Standards Association
22 (VESA) local bus, and a Peripheral Component Interconnects (PCI) bus (also
23 known as a Mezzanine bus).

24 Although the description above uses language that is specific to structural
25 features and/or methodological acts, it is to be understood that the invention

1 defined in the appended claims is not limited to the specific features or acts
2 described. Rather, the specific features and acts are disclosed as exemplary forms
3 of implementing the invention.
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